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DECORATION OF CERAMIC ARTICLES BY POLYMER-POWDER PIGMENTS

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A technology of industrial decoration of majolica, faience, porcelain, and pottery using polymer-powder pigments is developed and implemented. The technological schemes of single-color and multi-color decoration of ceramics using such pigments are considered. Polymer-powder pigments can be used to decorate a wide range of ceramic products using an energy-saving technology. Two decoration technologies can be combined in the following order: glazing – polymer-powder decoration.

Majolica, faience, porcelain and pottery are decorated using glazes, enamels, and ceramic pigments. This involves substantial time and labor consumption, as well as losses of nearly finished articles due to irreparable defects at the finishing stage [1].

With the emergence of polymer-powder pigments, which is considered to be a significant event in the 20th century in the field of varnish-and-paint technology, it has become possible to obtain high-quality protective and decorative coatings on ceramic articles using an energy-saving technology. For instance, polymer-powder pigments are fired (polymerized) at temperatures not higher than 150 – 200°C for 5 – 20 min, the pigment powder is spray-deposited on articles with minimum losses, and the powdered pigments are delivered to the customer ready for use.

The Polyton-K Company has developed a technological scheme for single-color and multicolor decoration of ceramics using polymer-powder pigments. Experimental samples were articles made of red-burning and white-burning clay at the Kungurskie Narodnye Promysly JSC.

The technological scheme of monochromatic decoration includes:

- cleaning, grinding, and decolorizing of the surface of articles to be painted after a first glaze-free firing;
- preheating of articles in a convection furnace up to a temperature of 120 – 160°C;
- pneumoelectrostatic layer-by-layer spraying of powder of a particular color on the preheated article up to complete filling of microirregularities of the surface to be painted;
- polymerization of the powder coating in a convection furnace at a temperature of 160 – 200°C for 5 – 20 min depending on the type of the pigment deposited;
- cooling of the colored articles in air.

Articles with one-layer polymer coatings are shown in Fig. 1.

The technological scheme of polychromatic decoration of ceramics includes:

- single-color decoration of the total surface to be painted according to the above technology, only replacing polymerizing by preheating of articles up to complete fusion of the spray-deposited pigment layer;
- pneumoelectrostatic spraying of the powder pigment of the second color on a prescribed part of the article surface;
- heating of the article up to complete fusion of the second pigment;
- pneumoelectrostatic spraying of the powder pigment of the third color on a prescribed part of the article surface;
- polymerization of the multicolor coating in a convection furnace;
- cooling of colored articles in an air medium.



Fig. 1. Products made of white-burning clay decorated with white polymer-powder paint.

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Fig. 2. A flower pot made of red-burning clay decorated with white (the first layer) and light blue (the second color) polymer-powder paints.



Fig. 3. Vases made of white-burning clay decorated using polymer-powder "antique" paints: *a*) "old bronze" + golden varnish; *b*) "old copper" + golden varnish.

Articles with multicolor polymer coatings are shown in Fig. 2.

The technological scheme of the varnish – pigment decoration includes:

- single-color or multicolor decoration of the article surface according to the above described technology, but instead of polymerization, the article is heated up to complete fusion of the deposited pigment layer;
- cooling of the heated article in an air medium to a temperature 20 – 30°C lower than the melting temperature of the varnish to be deposited;
- spray-deposition of the varnish powder over the layer of the fused paint;
- polymerization of the varnish – pigment coating in the polymerization furnace;
- cooling of colored articles in air.

Articles decorated according to the pigment – varnish scheme are shown in Fig. 3.

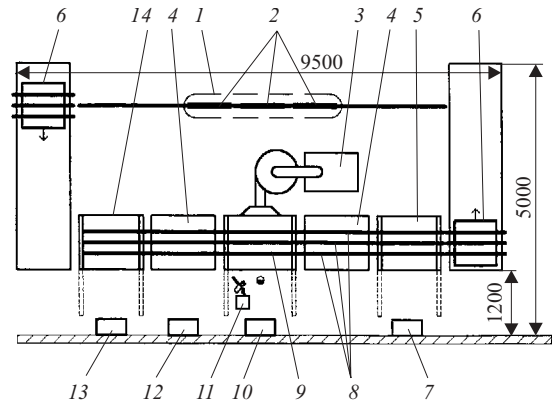


Fig. 4. Basic scheme of a production division for decoration by means of polymer-powder paints: 1) zone of cassette charging and unloading; 2) the first three cassettes; 3) recuperation unit; 4) hopper for cassette accumulation; 5) polymerization furnace; 6) transport carriers; 7) polymerization furnace control panel; 8) overpasses; 9) spraying chamber; 10) control panel; 11) deposition system; 12) air preparation block; 13) preheating furnace control panel; 14) furnace for preheating of articles before coloring.

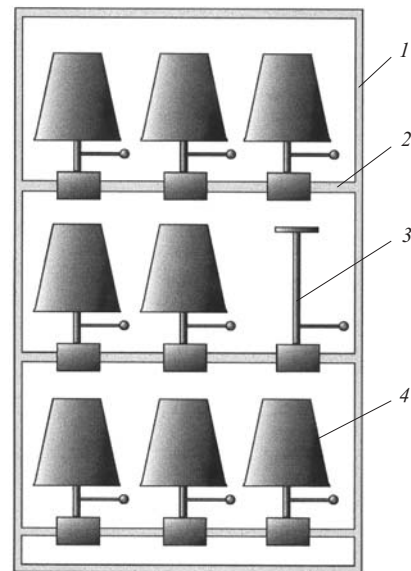


Fig. 5. Layout scheme of pots to be colored in a cassette: 1) cassette; 2) shelf; 3) rotating device; 4) pots.

Decoration of ceramic articles according to the described technological schemes provides for getting coatings with good exterior properties. The coating thickness is 80 – 100 μm. The adhesion measured by the lattice notch method according to GOST 9.410–88 correlates with the highest grade: 0.

According to a decision made by the Kungurskie Narodnye Promysly JSC and the Polyton-K Company, a production line for pneumoelectrostatic decoration of Kungurskie Narodnye Promysly JSC ceramic products using polymer-powder pigments was designed, built, and put into

operation. The line efficiency is designed for decorating flower pots of 2.1-liter capacity at a rate of 1026 pieces per day in two-shift operation.

The principal decoration scheme is shown in Fig. 4. and the scheme of the pots to be painted arranged in a cassette allowing for their rotation around their axes is shown in Fig. 5.

The operation of the decoration line has established that:

- decoration of ceramic articles on the line according to the developed technology produces coatings with good exterior decorative properties;

- white-burning clay in these articles can be replaced by red-burning clay without impairing the decorative properties of the coating;

- decoration defects can be easily remedied by special techniques or using special liquids;

- polymer-powder pigments are easily deposited on a glazed surface and can conceal glazing defects;

- firing (polymerization) of the polymer-powder coatings proceeds at a temperature of 150 – 200°C for 15 – 25 min;

- the pigment is easily utilized and almost totally recycled in the production process;

- no large space is needed for this decoration division;

Glaze coatings have certain better service (physical) characteristics compared to polymer coatings; therefore, decoration of ceramics with polymer-powder pigments is not a competitive technology but makes it possible to renew the product range and decorative designs. Furthermore, the two decoration technologies can be combined in the following order: glazing – polymer-powder decoration.

REFERENCES

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